UNITED STATES DISTRICT COURT
DISTRICT OF SOUTH DAKOTA
SOUTHERN DIVISION

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SIOUX STEEL COMPANY,
a South Dakota corporation,

Plaintiff,

vs. Civ. 15-4136

KC ENGINEERING, P.C., an Iowa
corporation,

Defendant.

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Videotaped Deposition of: JOHN W. CARSON, Ph.D.
Date: October 27, 2017
Time: 8:16 a.m.

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APPEARANCES

Mr. G. Verne Goodsell
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Rapid City, South Dakota

Attorney for the Plaintiff

Mr. Michael F. Tobin
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Sioux Falls, South Dakota

Attorney for the Defendant

ALSO PRESENT: Jason O'Mara

REPORTED BY: Audrey M. Barbush, RPR

VIDEOGRAPHER: Jeff Lambert



I N D E X



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STIPULATION

It is hereby stipulated and agreed by and between the above-named parties through their attorneys of record, whose appearances have been hereinabove noted that the videotaped deposition of JOHN W. CARSON, Ph.D., may be taken at this time and place, that is, at the offices of Boyce Law Firm, LLP, 300 South Main Avenue, Sioux Falls, South Dakota, on the 27th day of October, 2017, commencing at the hour of 8:16 a.m.; said deposition taken before Audrey M. Barbush, a Registered Professional Reporter and Notary Public within and for the State of South Dakota; said deposition taken for the purpose of discovery or for use at trial or for each of said purposes, and said deposition is taken in accordance with the applicable Rules of Civil Procedure as if taken pursuant to written notice. Objections, except as to the form of the question, are reserved until the time of trial. Insofar as counsel are concerned, the reading and signing of the transcript by the witness is not waived.

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THE VIDEOGRAPHER: We are now on the record. My name is Jeff Lambert. I'm the videographer. The deposition of John W. Carson is being taken on October 27, 2017, at approximately 8:16 at the location of Boyce Law Firm, 300 South Main Avenue, Sioux Falls, South Dakota.

This deposition is taken in the matter of Sioux Steel Company, a South Dakota corporation, vs. KC Engineering, P.C., an Iowa corporation, Defendant, venued in United States District Court, District of South Dakota, Southern Division, CIV-15-4136. Deposition was noticed by the plaintiff.

Would all counsel please voice identify yourself and whom you represent.

MR. GOODSELL: Verne Goodsell for the plaintiff, Sioux Steel.

MR. TOBIN: Michael Tobin on behalf of the defendant, KC Engineering.

THE VIDEOGRAPHER: Our court reporter today is Audrey Barbush. Would you please swear the witness.

JOHN W. CARSON, Ph.D.,

called as a witness, having been first duly sworn, testified as follows:

THE VIDEOGRAPHER: Go ahead, Counselor.

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EXAMINATION
BY MR. GOODSELL:
Q Thank you.
Mr. Carson, my name is Verne Goodsell, and I've invited you here today to help me understand your reports. And you've issued a report in this case; is that correct?
A Actually, two. Two, sir.
Q And I have those two reports marked as Exhibits 28 and 29, and they're in front of you, correct?
A Yes.
Q And those two exhibits are the reports that you have issued in this case?
A Yes.
Q Okay. And before we move into talking about the reports, I want to just chat with you a little bit about some of the areas of expertise that you have as it relates to this case.
A Okay.
Q And the first is, is I understand that you're a licensed professional engineer?
A That's not true, no.
Q Okay. And tell me what is correct then.
A I'm not a licensed professional engineer.
Q Okay. And do you have an engineering education?

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A I do.
Q And have you ever been a licensed professional engineer?
A No.
Q And then I can take it that you, then, have not -- as not being a licensed professional engineer, is that one of your areas of expertise is not going to be in the area of structural analysis and structural design?
A That's correct.
Q And in looking at in terms of your expertise, then, would I be correct to assume that falls more in the area of material flowing?
A That's part of my area of expertise.
Q Okay. And is that how you're approaching this case in terms of the material propensity and the flow of materials?
A That's part of my area, yes.
Q Okay. What other areas of expertise would you have that you're going to apply to this case and have discussed in Exhibits 28 and 29?
A The loads that bulk materials exert on storage structures.
Q Okay. And have I wrote that down -- the load of bulk material on storage structures; is that correct?
A The loads, plural, that bulk materials exert on storage

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structures, yes.
Q Okay. Any other areas of expertise that would apply to the opinions that you set forth in Exhibits 28 and 29?
A Could I just look through my report --
Q Absolutely.
A -- briefly and refresh my memory?
(Witness examines document.)
Well, there are topics related to the two that we just discussed, such as the codes that are -- have been published and -- that relate to the loads exerted on storage structures. That's really a subset of what I just mentioned a moment ago.
Q Okay. Anything -- what else?
A I have done extensive work over the years and have published extensively on the issues of failure of storage structures, structural failure of storage structures, analyzing the cause of failures. I've testified on this issue in litigation.
Q Okay.
A Related to flow are issues of how materials should be stored and handled, issues such as recirculation, the need for doing so, the use of flow aids, such as air cannons, the pressures that air cannons exert on materials and on storage structures. Related to flow is the issue of caking --

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Q Excuse me. Issue of what?
A Caking.
Q Caking?
A -- of bulk solids. Moisture migration and how that affects the propensity of materials to cake. I think that's a reasonable summation of my areas.
Q Okay. And then just so I can kind of follow up with, we're talking about the loading that bulk materials exert on storage structures, and then we're talking about the failure of storage structures and the cause of the failure.
A Yes.
Q And then we're talking about flow, which includes storage, flow aids, caking, and moisture content?
A Moisture content as well as moisture migration.
Q Okay. And can I assume, then, because you're not a licensed professional engineer, that you do not have any training in terms of accident reconstruction?
A I don't have any formal training in terms of accident reconstruction, but I have certainly been involved in numerous instances of looking at failure of storage structures and determining the cause of failure.
Q Right. And I want to distinguish between the investigation that has a cause of failure versus reconstructing what occurred before the failure.

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Q And perhaps I asked this earlier. I understand you're not a registered professional engineer. Am I correct that you never have been a registered professional engineer?
A That's correct.
Q And then I'm assuming then that you have not practiced engineering; is that correct?
A That's not correct.
Q Can you explain to me how you can practice engineering for clients without being a registered professional engineer?
A Certainly. By my education and training. There's no requirement that I have a professional engineering license. That would only be necessary if, for example, I were sealing drawings, particularly of a structural nature. And very often that's for a public agency. I've never done that type of work.
But my -- by my education, bachelor's in mechanical engineering, master's in mechanical engineering, Ph.D. from MIT in mechanical engineering, and working nearly 50 years in this field, I've never found it necessary, nor has any client required that I have a professional engineering license to do the work that I do.
And I've testified in numerous cases in both

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county, state, and federal courts, as well as international tribunals. That's never been a limitation in my being able to do the work that I do.
Q Can you explain to me why you chose to stay outside of the area of a registered professional engineer as you were pursuing these various areas?
A It's never been a requirement for the work that I've done. None of my clients have asked for that. I've never -- I've reviewed the requirements, and in my opinion and in the opinion of attorneys that I've consulted with, this has never been an issue. I've never been prohibited from testifying in litigation involving engineering issues, involving the issues of the type that we're talking about here. It's never been a requirement. The --
Q Okay.
A -- courts and others and my clients rely on my education and 50 years of experience in this field.
Q Yeah. And I wasn't challenging your education or your experience directly. My question was is that why did you choose to stay outside of the circle of being a registered professional engineer?
A I just never found it to be necessary. I didn't -- I had other things that were more important for me to do.
Q I want to talk to you --

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(Exhibit 30 is marked for identification.)
BY MR. GOODSELL:
Q You have in front of you what has been marked Exhibit 30. Can you identify that for me?
A Yes, sir. Exhibit 30 is a screenshot of an internal software program that we use in my office. This particular screenshot has to do where we record contacts with clients or potential clients so that we can share this information internally with all of the engineers in all seven of my offices around the world.
This particular one has to do with several contacts that individuals in my firm had in 2012 with Chad Kramer from Sioux Steel Company.
Q Now, one of the things that I wanted to address with you about this is that, in the dialogue here, Chad Kramer specifically identifies that the bins are for use with grain bins, correct?
A I'm sorry. Could you say it again?
Q Yeah. If you look at the bottom of that exhibit, I think the third line down there is that Mr. Kramer is talking about Sioux Steel and the hoppers for use with grain bins.
A Yes.
Q So we're talking about grain, correct?
A That's correct.

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Q And then as we go up farther is that they actually sent to you to -- and how do you pronounce the name of your firm?
A Jenike & Johanson.
Q Okay. So Jenike, then, through your engineer requested assembly drawings?
A Yes.
Q And they were sent to you for review, correct?
A Not to me personally but to our company, yes.
Q To your company, correct. Okay.
And then they were reviewed, and it also has in there the bulk density of the materials, correct?
A Yes. Mr. Kramer's email of July 17, 2012, states the -- quote, the hopper bins are designed for materials with a bulk density of up to 55.3 pounds per cubic foot, closed quotes.
Q And then if we go to the top of that is that I believe that it's your engineer saying, quote, our loading is much higher compared to that -- to what Sioux Steel calculates.
Did I read that correctly?
A Yes, sir.
Q Now, would it be fair, based on your review of this case is that, when the hopper plans were submitted, is that those plans were submitted to be in compliance



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with EP 433? Would that be a fair statement?
A I don't know whether it's fair or not. There's no indication here that that's the case.
Q If the plans were compliant with EP 433, would I interpret this document from your engineer that the loading calculations done under EP 433 are not sufficient for your firm in terms of loading being much higher than that?
A I don't know. Unfortunately, this is all of the information that we have in our files about this -- about this interchange, and the individual, Mr. Petro, listed at the top as the project development engineer, Gregory Petro, passed away a couple of years ago. And so I have no way of knowing beyond what's here what information he was given.
Whenever we are approached by a potential client and given information, if it looks like there's no likelihood that that will result in our writing a proposal or doing a project, then we just simply don't save that information any longer.
So I don't know, to answer your question.
Q And I'm not being critical of the information that was or wasn't saved or how it was saved. Is that what I'm observing here is the opinion of your engineer that your loading, i.e., your company's loading, is much

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higher compared to what Sioux Steel calculates. That's what it says, correct?
A That's what it says, yes.
Q And this would then be the loading, material loading inside the structure, correct?
A The loading of the -- that the material exerts on the structure, yes.
Q And if the plans submitted by Sioux Steel to your company were in compliance with 4 -- EP 433, then your engineer is telling the Sioux Steel engineer that your loading is much higher for your firm than what Sioux Steel calculates?
A That certainly is potentially the case, yes, and probably that's a likely conclusion. But, again, I don't know anything more than what's here. So...
Q Okay. And I understand that. Now, this is a document -- 30 was the first time your firm was involved in anything with Sioux Steel. Would that be correct?
A That's correct. The first time we had had any contact with Sioux Steel, to my knowledge.
Q Is it your opinion that EP 433 is not the appropriate standard for loading of grain and materials that have a bulk density of 55.3?
A I wouldn't categorically say that, no. It depends on

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the properties of the grain as to whether EP 433 is appropriate, as I've stated in my Exhibit 28 opinions.
Q Are there any other U.S. standards that are recognized for steel storage bins other than ANSI and ASAE EP 433?
A That is the only current U.S. standard.
Q Now, the bin in question that failed, the upper section of the hopper was not in accordance with EP 433 or for the Manual for Steel Construction. Is that a fair statement?
A Could you be more specific when you talk about the upper portion?
Q Yeah, upper portion of the hopper. I think it consists of 80 panels, and it is the portion that would go into the ring right below the top of the bin.
A And your question is whether it was in accordance with EP 433 and standards, AI -- AISC standards?
Q Correct.
A Well, first of all, EP 4 -- as I've stated in my report, EP 433 is not applicable to the design of this bin. So to say whether it was in accordance with or not is, in my mind, immaterial.
Q And I understand that, and I'm not arguing with you on that. I just want to set the ground rules, though, that it doesn't comply with EP 433 or AISI, the steel construction manual.

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A The design of the upper portion of the hopper of this bin does not include the appropriate safety factors in accordance with AISI using the loads from EP 433.
Q Okay. Now, let's pursue, then, is that it's your opinion that EP 433 -- and I'm going to just use that for short rather than going through all the nomenclature on it -- doesn't apply to materials that potentially become nonflowing?
A The term, sir, is non-free-flowing.
Q And I think in your report you talked about the potential to become non-free-flowing, correct?
A That's correct.
Q Now, is there anything in EP 433, or any subsequent comments to EP 433, that would caution an engineer that it doesn't apply to materials that had the potential to become non-free-flowing?
A Certainly.
Q And where do you find that in EP 433?
A Right in the title, to begin with. It says for free-flowing material. And then there's other statements which I've summarized in my report that elaborate on that issue.
Q Okay. Now, it also talks about free-flowing grain, specifically wheat, because wheat has the heaviest bulk density of the common grains; is that correct?

A I believe that's true, yes.
Q It also talks about granular fertilizer, doesn't it?
A I don't recall off the top of my head.
Q Okay. Well --
A I don't have that --
Q I understand.
A I don't have that standard recorded --
Q And --
A -- in my memory, but if you can provide me a copy, I'd be happy to confirm that.
Q Well, I may or may not be able to. Let me see if I've got that handy.
I'm going to hand you what's been marked previously Exhibit 26.
MR. GOODSELL: And for the record, I'll state on that exhibit that the yellow highlighting is material I put on there, Counsel.
MR. TOBIN: Understood.
BY MR. GOODSELL:
Q Is that if we look at Exhibit 26, Mr. Carson, we talk about loads due to bulk grains and fertilizer, correct? First sentence.
A You've only read part of it, sir. It was developed by the ASAE Loads Due to Bulk Grains and Fertilizers Subcommittee of the Structures Group.



So this was the subcommittee that developed this. It doesn't say that this standard applies to fertilizers. Indeed the title says free-flowing grain. It doesn't mention fertilizer.
Q What is the position of the subcommittee, then, in terms of fertilizers?
A Well, not being a member of that subcommittee, I don't know, but having worked with ASTM, American Society for Testing Materials, and other standards writing organizations, there are committees and subcommittees that have a broad charter, and within that broad charter they develop standards that don't necessarily apply to the broad charter of the subcommittee.
Q Well, let's approach it this way. Fertilizers have the potential to become non-flowing granular fertilizers, correct?
A Yes, sir.
If I can just elaborate on my previous answer. If -- refer you to section 1, Purpose, subsection 1.1, quote, this engineering practice presents methods of estimating the grain pressures within centrally loaded and unloaded bins used to store free-flowing agricultural whole grain, closed quotes. There's no mention of fertilizer in the purpose.
Q Okay. Does a free-flowing grain, such as wheat, corn, or soybeans, have the potential to become nonflowing?
A It has the potential, yes. And, again, sir, just to -- for semantics, but the term is non-free-flowing, not nonflowing.
Q So I'm correct then -- or it is correct that grains such as wheat, corn, and soybeans have the potential to become non-free-flowing?
A That's correct.
Q And that potential exists when they're in the storage hopper bins, correct?
A Yes, sir.
Q Okay. Does EP 433 address the structural design that is necessary if a free-flowing material becomes non-free-flowing?



A First of all, EP 433 does nothing in terms of struct -- says nothing about structural design. It's simply having to do with loads on structures. And second, it is -- again, as we've talked several times here, or as I've testified, EP 433 simply talks about the loads when the grain is free-flowing. It says nothing about what happens when the grain becomes non-free-flowing.
Q So when the grain becomes non-free-flowing within a compliant 433 bin, what dynamic forces are necessary to be considered then when you are designing the structure?



A EP 433 is silent on that issue.
Q Now, EP 433 addresses in the hopper the dynamics of the material, correct?
A It addresses what happens when materials flow in the hopper, yes, and the resulting loads.
Q And is it your interpretation of EP 433 that those material loads only apply when the material is free-flowing?
A Yes, sir. As far as EP 433 is concerned, absolutely.
Q Where else in the literature can I look for publications that would warn that EP 433 does not apply when a free-flowing material becomes non-free-flowing?
A I don't recall specifically within the literature, but it should be obvious to anyone, even without an engineering knowledge, to read the title of EP 433 and learn that it's only applicable for free-flowing grains.
Q And I noticed that in your opinion. I'm not arguing with you about your opinion, John. Is that I'm looking for validation from other sources that are saying that EP 433 does not apply to a situation where a free-flowing material becomes non-free-flowing?
A Well, I've written several papers on loads applied to silo structures, failure of silos, and I've written specifically about the limitations of EP 433. All of



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those papers, I believe, are referenced in my opinion, particularly --
Q Yeah. And what I'm looking for, though, is confirmation of those opinions by other experts in flow materials and in structural analysis that would agree with you that EP 433 doesn't apply when the material is non-free-flowing -- potential for non-free-flowing.
A Well, I -- again, I've -- I've referenced in my report there was a paper by Dr. Gurfinkel. This is footnote 46. I don't -- I don't recall specifically what he says, but it talks -- he talks about a project that actually I was involved in myself, and he referenced the work that my firm did on this, which was a silo for storing soybean meal.
Q That was the one in 1979 in Iowa?
A The failure?
Q Yes.
A That's my recollection.
Q Okay.
A That's about the right time frame, yes. And I believe it was Iowa.
I mean, there are other standards out there, the Eurocode EN 1991-4 doesn't reference EP 433, but it talks about this issue of free-flowing and non-free-flowing. And it is very specific as to the

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limitations of that particular code.
Q Okay. And which code was that? I'm sorry.
A It's -- it's -- it's British standard E --
Q Okay. That's --
A -- EN 1991-4.
Q Yeah, the British code or the Eurocode?
A It's one of many British codes or Eurocodes, yes, but it's referenced here. I'm sure it's in one of my footnotes. It's footnote 40, page 9 -- at page 10.
Q I've looked for it, but I have not found it, outside of suggestions in your publications, for a direct statement that EP 433 does not apply to materials that have the potential to become non-free-flowing.
Can you point me to any place outside of your writings and other than the footnotes 46 and 40 that would address that issue?
A Sir, as I testified a few moments ago. It's -- to me, it's obvious to anyone reading the English language by the title of EP 433, by 1 -- paragraph 1.1 that this only applies to free-flowing grain. If the grain becomes non-free-flowing, it should be obvious that this standard does not apply. I don't know that anyone has to state that any more directly in any publication to make it obvious.
Q Okay. And I understand it's your interpretation it's

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obvious and that's your reading of it, but my question was is that has this obvious "does not apply to potential non-free-flowing materials," has that been addressed by someone else out there specifically?
A Not that I recall. I don't --
Q Okay.
A Again, it's like saying the sky is blue at times. I mean, to me it's such an obvious statement I don't know why anyone would have to state it.
Q Now, if we go back to EP 433 and in reference to the overpressure, which I think is calculated as F --
A Yes.
Q -- is that is it my understanding that it's your opinion or interpretation of EP 433 that the overpressure factor there, which I think is 1.4, is that that factor only applies when the material is free-flowing and would not apply when there's a potential for the material to not -- to be non-free-flowing?
A Well, since -- since Table 1, which includes values for F, is part of EP 433, then I would -- my opinion is that this table only applies for free-flowing grain.
Q Okay. Now, help me to understand this, because I may not understand the materials flow as well as I should. But if a bin is full of grain and it's free-flowing,

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then it's going to move out of that bin in a uniform pattern at the discharge, correct?
A How do you define uniform?
Q Well, continuous, it's free-flowing, it's going to flow based upon, you know, the amount of flow that may be mechanically manipulated.
A Yes, that's a reasonable statement.
Q So then the internal pressures on that as the materials flow out would become less and less in terms of the internal hoop stresses on the bin and hopper?
A Less and less relative to what?
Q Relative to where they started from.
A As the bin empties out?
Q Yes.
A Yes, that's true. Over time that's true.
Q So we have a bin --
A Eventually you get to a point where the bin is empty and there's no pressure.
Q Correct.
A So, yes, they are decreasing but not uniformly. You know, bulk solids are very different than liquids in that regard.
Q Would there be any substantial change in the hoop stress at the top of the hopper during that discharge process in being going from full to empty?



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flow pattern where material is flowing along the hopper walls, the pressure that the material exerts against the hopper walls and, hence, the hoop stress that develops in that hopper, in the hopper wall itself, increases dramatically as soon as flow commences. And it remains at a relatively high value until the level drops to a point where then it starts to decrease, and eventually we get to the point where the material level is below the top of the hopper and we go back to zero. Zero pressure, zero hoop stress.

Q And that's when we have a mass flow condition in the hopper, correct?

A Correct.

Q Okay. Then let's talk about in terms of what happens when we have a funnel flow condition in the hopper.

A Okay. If we have a funnel flow condition in the hopper, then those pressures and, hence, the hoop stresses do not change from the initial fill conditions to the discharge or flow conditions. And that's well-established in various standards. It's well-established in the literature that that's -- that's the condition that occurs.

Q So at the collar, if we have a funnel flow, there is no change of condition in the hoop stress; is that correct?

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A That's correct, at least initially. Again, it's going to decrease over time as the level drops. But at least initially there's no change from that initial fill condition.

Q Does EP 433 address mass flow?

A It does, although the term mass flow is not used. EP 433 uses the term plug flow to mean essentially a mass flow condition.

Q And I looked at that, because plug flow means that all or part moves on the sides, correct?

A Let's be more specific in terms of looking at the wording.

(Examines document.)

Q I think it's on page 1, 2.19. Are you with me?

A Yes, I am.

Q Okay. Take your time. I'm not trying to --

A Yes. Yeah. You're correct. It's 2.19. The reference is to Figure 1, and I stand corrected. Actually -- well, Figure 2 shows a mass flow bin.

Q Well -- and what I was pursuing, and I'm not trying to, again, argue with you, is that I understood you to tell me that mass flow under EP 433 is the same as plug flow. Did I understand that's what you said?

A That's the statement I made, and I said this -- I stand corrected. The terminology does differentiate and does

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refer to mass flow in 2.1.7, the Figure 2.

What I quoted in my report is actually the commentary, which is on page 947, paragraph 5.1.2.2. And, again, where you've highlighted and you have a letter B next to it, plug flow is defined as flow from a bin in which all or part of the material moves as a unit with material movement along the wall -- the bin walls.

To me that's -- again, that's mass flow. But I stand corrected.

Q Well, no. I appreciate that.

A Yeah.

Q I understand that viewing the commentary may be a little bit different than how it's set forth in the definition.

A You're absolutely correct, yeah.

Q But I was just trying in my own mind is to distinguish is that mass flow is not the same as plug flow.

A You are correct. I --

Q And plug flow, as it's identified here, is when all or part of the bin walls material is flowing along?

A You are correct. I stand corrected.

Q Now, I want to go back. As I understand, we're talking about, with a funnel flow bin -- which is the type of bin we have in this particular case of the failure,

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correct?

A That's correct.

Q -- is that there's going to be no change in the hoop pressures at the collar during discharge or unloading?

A That is -- that is my opinion. That is well-established in the literature. It's certainly well-established in several other codes that are in existence, including the most modern code, this British standard that I referenced earlier.

Q Okay. Now, what I'm struggling with as a layperson is that since the parameters of the structure in terms of the loading that we have when it's low is that -- and is static, we understand what type of structure it takes to hold that static load, correct?

A Yes. Well, I think so.

Q Okay. Well, the literature -- the literature talks about it. I don't know that I understand it or not, but the literature understands, with a static load, this is what we have to have to support it so there won't be a failure, correct?

A Right.

Q Now, then, if we go to EP 433, it begins to talk about dynamic load.

A Uh-huh.

Q And that would be, then, the change as it discharges



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and what happens to the materials as it's discharged from full to empty, correct?
A. Yes.
Q. And what I'm struggling with is what change would there be in dynamics at the collar of this hopper if we have a funnel discharge and there's no change in that dynamic, why do we have to address dynamic load to any specific level, because it would seem that the same static loading on it would be able to handle the material because there's no change at that collar level?
That was a long question.
A. I'm not sure I understand your question.
Q. Okay.
A. Could you restate it, please.
Q. Well, I probably can't. Let me see if I can kind of rephrase that.
What I'm struggling with is, is that if there really is no change in hoop stress in terms of discharge from full to empty in a funnel flow, why is it necessary to discuss dynamic loading --
A. Discuss it --
Q. -- as it's discussed in EP 433?
A. That's a good question. EP 433, in my opinion and I think in the opinion of most experts in this field, is

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a highly simplistic, very inadequate design code. There are many -- well, not many. There are several codes and certainly a vast amount of literature that are consistent with my opinion, which is that if you have a funnel flow vessel, the change in pressures near the top of the hopper from an initial fill condition to a discharge condition is essentially zero. There is virtually no change in those pressures.
That's contrary to what's stated here, I recognize. But, again, this is, again, a highly simplistic and not very well-presented document, in my opinion and the opinion of, I think, most experts in the field who have studied this area.
Again, solids and liquids behave very differently. If you have a --
Q. And I don't want to -- we've got little time here, and we don't want to talk about liquids. We're talking about solids here, correct?
A. Yes.
Q. Okay. So you don't have an explanation, though, if there's no change in the pressure, particularly at the area we're talking about, at the hoop collar, as to why we would go into some discussion then about the dynamics of the load because that would suggest that the loading pressures are changing.

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A. I don't have -- I'm not a member of this committee. I wasn't part of writing it. I don't know why they would consider that because it's contrary to most of the literature.
Q. The -- and I understand your criticism of EP 433, and yet that's the only standard that we have in the United States that deals with steel bins.
A. That is correct.
Q. Now, I want to move into talking about some of the reasons why a potential free-flowing material -- a free-flowing material has the potential to become non-free-flowing. And there's going to be some type of obstruction that occurs in the flow process; is that correct?
A. I'm not sure what you mean by an obstruction.
Q. Obstruction.
A. Well, there is -- there is something that causes the flow to be affected, either slowed down or stopped. Could be a mechanical interruption or, more likely, when it deals with the material itself, it has to do with something that happens to those particles to cause them either to not slide at the walls or to stop flowing.
Q. And common problems with flow are referred to as ratholing?

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A. That's one.
Q. And ratholing can occur in a funnel flow bin.
A. It can occur, yes.
Q. And the other one that seems to be in the literature is talking about arching or bridging.
A. That's correct.
Q. Now, since grains have the potential to become non-free-flowing, is grain then going to, in a funnel flow bin, be subject to ratholing and arching?
A. Again, it has the potential of those problems occurring, but if it's a free-flowing material, those problems will not occur.
Q. Right. So as long as it's free-flowing there's no problem, correct?
A. There's no ratholing problem. There's no arching or bridging problem. That's correct.
Q. That's right. So there's no additional stress -- and we talked about that before -- as long as it's free-flowing?
A. Well, when you say we talked about it before, I mean --
Q. At the collar.
A. That really has nothing to do whether it's free-flowing or non-free-flowing. What we were talking about before is whether you have funnel flow or mass flow. We're talking about the flow pattern, not flow problems.

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Q Okay. But let's go back to flow, and I probably went off on the wrong direction on that.
Let's go back to flow, is that grains have the potential to become non-free-flowing, and non-free-flowing then has the same potential that grains can have the problem of being ratholing as well as arch and bridging?
A That's correct.
Q Now, these phenomena, ratholing, arching and bridging, with material such as grain or other bulk solids, have been known to the industry for a long period of time, correct?
A Absolutely.
Q And so one of the hazards in terms of material handling in a funnel flow bin is known to be ratholing and arching?
A That's -- those are both potentials, yes.
Q And those are potential hazards in terms of danger to the structure?
A Among other things, yes.
Q And what other dangers would they have? I assume that if it's a flow problem, you can't use it, so it's a function problem?
A That's correct.
Q So the hazards of ratholing are structural, when it

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collapses?
A Yes.
Q And the hazard to ratholing -- and I'm going to refer to ratholing and arching as the same problem, unless you want to distinguish --
A I'd like to distinguish because they are very different problems, and one -- two of those occur in funnel flow bins and one of them -- or can occur in funnel flow bins, and one of them can occur in a mass flow bin.
Q Okay. Well, let's just take it, then, that ratholing is that one of the things that, when the rathole collapses, that's a hazard to the structure?
A Correct.
Q And when the ratholing occurs, that means that it's going to be difficult and it's not going to function properly at discharge?
A That's correct.
Q And the reason is the stuff sticks along the walls and there's a little rathole that goes right down the middle, so to speak, and then the flow stops?
A That's correct.
Q Okay. And then with arching is that that's simply something that blocks the flow someplace in the hopper or the bin?
A That's correct.

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Q And that also, when it collapses, can be a hazard to the structure?
A That's correct.
Q And, again, these hazards to the structure from ratholing and arching have been well-recognized and known for a long time in the industry and profession?
A Yes.
Q Now, with arching, then, also the function of the bin is destroyed; is that correct?
A Yes. That's --
Q Can't get the material out.
A Correct.
Q Okay. Is it your opinion that the overpressure, as discussed in EP 433, doesn't take into consideration the dynamic forces created when either a rathole or a arch collapses?
A Yes.
Q So -- I'm not sure I understand that, and perhaps it's how I asked the question. Is that the overpressure in EP 433 is not addressing ratholing and arching?
A That's correct.
Q Is that your opinion?
A Yes.
Q I want to shift with you and talk just briefly a little bit about your personal experience with hopper bins

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that have failed.
A Okay.
Q Other than the one we talked about in Iowa, which I think was in '79, are there other failures that you've investigated in hopper bins where there has been a complete failure of the hopper such as occurred in this case?
A Yes.
Q And can you identify those for me?
A Well, I would, first of all, refer you to footnote 45, which is a paper that I wrote back in 2000, which provides a number of examples, case histories of silo failures, and several of those involve hopper-bottom bins.
Q So we have two of them in your paper under footnote 45; is that correct?
A I don't recall how many are in there. There's at least two. There may be more. I don't recall.
Q And I've looked at that paper, but as I sit here, I don't know whether it was specified how many of them you actually studied in terms of hopper failure similar to ones we have in this case.
A I've investigated many hopper failures. I don't know the number but in the dozens of bins and silos that have failed in the hopper section.



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Q And what I'm talking about is a catastrophic failure where the entire hopper gives out and the entire load is dropped.
A Absolutely.
Q Okay. Now, on any of those did you personally determine what the design standard was for the hopper?
A Yes, I did.
Q Okay. And which ones would you have determined the design standard for the hoppers on?
A Which ones specifically?
Q Yes.
A Well, there's several that come to mind. There was a failure -- in fact, this is one that's described in this paper, footnote 45. This was a series of bins. I think, as I recall, there were eight or ten altogether. Only one of them failed, but the others were about to fail. This was at a chemical processing plant in Texas. The material was polystyrene fluff that was being stored. That's one example.
I can think of another one somewheres out in the Midwest, some type of a grain material. I don't know if it was an ethanol plant. I don't recall. But that was another one where the hopper failed.
There was another one I recall in western Massachusetts that was, again, at a chemical processing

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plant. In that case, it was polyethylene or polystyrene pellets. There were a bunch of silos at various chemical plants in the U.S. back in the 1970s that I investigated. This was, again, a chemical processing plant. There have been a number of them over the years that I've investigated.
Q Okay. And I'm not trying to make you recall all of those. What I'm really interested in, though, is that the specific ones that you have investigated that involve a grain or agricultural material, and on those we have the soy one in Iowa in '79 and then the ethanol one you just described?
A As I recall it was ethanol. I'm not positive of that. But it was -- it was one in the western part of the U.S. or Midwest, I don't recall.
Q And the material would have been what?
A At this point I can't recall, sir. I'm sorry.
Q Okay. So going back to the Iowa failure, is that did you determine the design standard on the hopper that failed?
A I determined the standard that was used, yes.
Q Okay. And what standard was used?
A As I recall -- and this goes back to --
Q I understand.
A -- the '70s. 30, 40 years ago.

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As I recall, even though it was a steel bin, I think they used the ACI code, if I'm not mistaken, which even though it's for concrete, I mean, the storage -- the vessel itself doesn't affect the loads. It's the material that affects the loads as well as the flow pattern. So -- again, this is 40 years ago. I don't recall that specifically.
Q Okay. And what I'm really looking for here, I'm looking for a case where you have done the investigation, there's been a hopper failure, and there's confirmation that the hopper design was consistent with EP 433.
A I can't recall a specific instance of that.
Q Okay.
A It probably has. Again, I've been doing this for nearly 50 years. I've looked at a lot of -- literally hundreds of failures. I don't recall a specific one sitting right here.
Q As you sit here today, you have no recollection?
A I don't have a specific recollection, no.
Q Okay.
MR. GOODSELL: Are you okay if we take a break, Counsel?
MR. TOBIN: Sure. Absolutely.
MR. GOODSELL: Okay.

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THE WITNESS: That'd be great.
THE VIDEOGRAPHER: The time is 9:39. End of media unit 1. We're off the record.
(Recess taken from 9:39 a.m. to 9:54 a.m.)
THE VIDEOGRAPHER: We are back on the record. The time is 9:54. This begins media unit No. 2 in the video deposition of John Carson.
Go ahead, Counselor.
MR. GOODSELL: Thank you.
BY MR. GOODSELL:
Q I want to kind of just go back and visit a little bit about your criticisms of EP 433.
Now, have you ever filed with either ANSI or the American Society of Agricultural Engineers a proposed comment --
A No.
Q -- to EP 433 that would address the issues that you have discussed with me today as to the limitations under your interpretation of EP 433?
A Not that I can recall. No, I don't believe so.
Q Are you aware of any of your colleagues that may hold a similar view to yours having done that?
A Not that I'm aware of, no.
Q Okay. Let's move then to -- earlier you said you had opinions as to what caused and didn't cause the

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accident in question.
What caused the accident in question? And I'm not so interested in the opinions that you expressed, and I'm not foreclosing that either, but I just want to know, in lay terms, why did that happen?
A. In my opinion, it happened for one of two reasons. Either it happened because of additional pressures exerted on the material and on the hopper section of the silo because of the firing of air cannons or -- and I think perhaps -- I won't say perhaps, I would say, or more likely the failure occurred because of the sudden collapse of an arch or a rathole.
Q. Now, in regard to the opinions of the additional pressure on materials on bin walls from the air cannons, have you done any specific calculations of those additional pressures?
A. I have not done any specific calculations. But in my report, Exhibit 28, I discuss the pressure that is in the cylindrical portion of each of these air cannons, which according to Mr. Nohr, as I recall, was 140 psi.
And as I note in my report, that's at least in order of magnitude, at least a factor of 10 greater than any material-induced pressures, that is, material-induced pressures on the hopper or silo walls.
So that's the extent of my analysis.

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Q. And when you say increased by a factor of 10 as to material-induced loads, that would be at the time that the rathole and material in the bin was stable?
A. I'm not sure, when you say the rathole and the material --
Q. Okay.
A. I'm just saying in terms of initial pressures which would be the same as discharge pressures, given it's a funnel flow bin, in looking at Mr. Godoy's calculation from ESI, confirmed with internal calculations done by Dr. Craig or Mr. Wu at my firm, I'm just saying that the magnitude of those pressures of the grain against -- or in this case, the soybean meal against the hopper walls, that that -- those pressures are on the order of 10 percent or less of the pressures of 140 psi from an air cannon.
Q. Well, how do we calculate the factor of 10?
A. Well, again, sir, if -- and I don't have it in front of me, but if we were to look at Mr. Godoy's calculations, he has the pressure that the material exerts. He's calculated the pressure the material exerts against the hopper section.
And if you could provide me that report, I could look at those numbers. But I'm just saying that, as I recall, those pressures are less than 15 -- less than

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10 psi, pounds per square inch. So I'm comparing those pressures to the 140 psi that Mr. Nohr reported as being the pressure in the air cannon.
Q. Okay. So just to make sure I'm following this correctly is that -- is that before the air cannon would have been fired, the load factors on psi would be in that 10 or 15 percent against the cylinder wall?
A. Well, let me -- you know, we're not talking the load factor. We're talking loads. And we're not talking percentages. We're talking psi.
Q. Okay.
A. I'm just saying that those pressures, as I recall from Mr. Godoy -- and if you could provide me, I could look at that report. But those -- as I recall, those material-induced pressures against the walls of the cylinder and hopper were less than 10 to -- 10 or 15 pounds per square inch. And I'm comparing that to the 140 psi that Mr. Nohr reported as being the pressure in the air cannon.
Q. So let me see if I can rephrase the question correctly. Is that, under the normal loading, there would have been 10 or 15 psi material-induced load against the cylinder wall?
A. Cylinder or hopper wall, yes.
Q. Or hopper wall.

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A. Yes, sir.
Q. Okay. And then with the air cannon, which has 140 psi, is that that's how you get to the 10 times?
A. That's correct.
Q. Okay.
A. And, again, I'm talking order of magnitude here. It could be that the pressures are less than 10 psi. I don't recall offhand.
Q. And I'm just trying to understand the process.
A. Right.
Q. And I understand the numbers may vary depending upon which ones you apply --
A. Right.
Q. -- and the results. Okay?
A. Understood.
Q. All right. In your opinion, an increase of pressure on the cylinder walls of 140 psi, would that be sufficient to cause a failure either of the field metal or the seam of a hopper designed pursuant to EP 433?
A. It could, yes.
Q. Now, can you say that it would to an engineering certainty?
A. Well, the issue, sir, is we have a certain pressure -- according to Mr. Nohr it's 140 psi -- in the cylinder of the air cannon. Now, there's a quick-acting



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solenoid valve that, once it's activated, that pressure is then -- or the air that's in that cylinder is released into the vessel.

At the instant it's released, you have essentially 140 psi directly around the nozzle of that air cannon. And depending upon the permeability of the material in the vessel, it will determine how that pressure wave then dissipates within the vessel itself.

So, again, it's potential. And I've seen instances where air cannons have caused failure of bin and hopper sections. Very often there's some sort of a reinforcement ring around the nozzle to reinforce the walls of the cylinder or the hopper to make sure that that pressure does not cause failure.

Q Now, the maximum pressure that could be exerted, though, with a cannon at 140 psi would be if there was no absorption of materials and all of the force was back into the wall would be 140 psi?

A Potentially, yes, sir.

Q And just like a gun, if you shoot it, the shotgun shell, the material goes clear out there. But if you plug it up, it's going -- it's going to blow up.

A Yes, sir.

Q Okay. Now, are there any studies that you have that show that the seams, if they were EPA [sic] compliant,

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would have separated or breached on 140 psi?

A What do you mean by EPA compliant?

Q In other words, if it was compliant with EPA [sic] standards. In other words, the hopper was not. We know that.

A If you're referring -- I think there's some confusion, sir.

Q Okay.

A You're referring to EPA standards. I think you mean EP 433.

Q I do. I do. I do that. And I'm talking about EP 433. Sorry on that. It's getting late.

But if we go back to that, if we have an EP-433-compliant hopper design, is there anything in the literature out there that would show me that a 140 psi cannon would cause the seam to breach?

A Well, again, some corrections here. EP 433 only deals with pressures of material against walls. It doesn't have anything to do with the ability of the wall itself or the bolted joint to resist those loads. That would get into AISC or AISI calculations. So...

Q Yeah. And the ASI [sic] is probably what I need to refer to that. Is that --

A That would be more appropriate.

Q Is that the ASI [sic] calculations for steel seams, is

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that if it's compliant with that standard, is there any evidence out there that 140 psi of pressure will cause that seam to breach?

A I'm not aware of anything that specifically addresses that, but, again, AISI, AISC both deal with the ability of -- among other things, the ability of a bolted connection to resist hoop stress or pressure that's acting perpendicular to that bolted seam.

And so given the fact that whatever pressure that the -- that is exerted against the walls of a cylindrical or hopper section of a storage vessel, those pressures acting normal or perpendicular to the wall are going to generate hoop stresses, and those stresses then are going to act perpendicular to that -- to that bolted seam.

If the pressures indeed are 140 psi, which as I said may or may not occur, but if they were to occur, it would stand to reason, then, that that seam would fail.

Q Okay. Now, that last portion, stand to reason, is that I'd like to have the engineering basis for why a 140 psi force from a cannon would separate the seam.

A Okay. We're talking now of a potential failure situation. I'm not saying it would necessarily occur. Indeed, there are many, many vessels that use air

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cannons where this doesn't -- this does not occur. It's more common in weaker storage structures such as we're dealing with here, that is, bolted steel structures as opposed to welded structures. And the vast majority of applications of air cannons involve some sort of a reinforcement plate near the nozzle to strengthen that connection so that there isn't a failure.

What I'm simply saying is, pressures that act normal or perpendicular to a hopper wall, whether they be pressures from material or pressures from an air cannon, that those pressures generate hoop stresses, and once the hoop stress reaches the limit of the ability of a bolted seam to resist those hoop stresses, the seam is going to fail.

Q Okay. And I understand the theory. What I'm looking for is the documentation. I'm looking for documentation that 140 psi from an air cannon would cause a bolted seam in the hopper to separate.

A I'm not aware of any documentation, but, again, it stands to reason that if you follow the calculations in AISC or AI -- AISI, that if you have sufficient hoop tension on a bolted joint in a hopper, it's going to fail. There's a limit to what it can withstand, and once you exceed that limit, it's going to fail.

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Q And I understand there's going to be a limit to it. My question still goes back and my inquiry goes back to is that how do we know that 140 psi force on the hoop stress would have been sufficient to cause a seam failure?
A Well, again, terminology. 100 ps -- '40 psi is not a force and the 140 psi is not acting -- it's acting normal or perpendicular to the wall. As a result of that pressure, there is hoop stress, additional hoop stress applied in the hopper. And all I'm saying is that, in a joint, whether it be a bolted joint or a welded joint or simply a piece of metal, it has a certain limit. It reaches yield. At that point it starts to deform. It can reach ultimate, in which case it fails. There is a limit to what that value is. And if -- if one were to increase that pressure sufficient, that is, the pressure internally, to create additional hoop stress, eventually you're going to reach a point of failure.
Q Now, earlier you said that it could, and so I want to pursue that in terms of a possibility versus a reasonable engineering probability.
Is it your opinion to a reasonable engineering probability that the air cannon firing at 140 psi caused the seam in the hopper to breach?

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A I believe that's less probable than the second mechanism that I described earlier. It's possible but not probable.
Q So it's not likely; is that fair?
A Yes.
Q And then the more likely cause of what happened here is a collapse of either an arch or the rathole?
A Yes, sir.
Q And those forces then caused it to collapse, correct?
A In my opinion, that was the most probable cause of failure, yes.
Q Okay. Now, I want to just talk with you a little bit about hoop stresses in the hopper.
A Okay.
Q Okay. If we have a loaded hopper like we have in this case is that the hoop stress at the outlet or the bottom of the hopper is going to be lesser than the hoop stress at the top of the hopper at the collar. Would that be correct?
A In general, that's correct, yes.
Q And the reason why the hoop stress is less at the bottom than it is at the top is simply a mathematical formula in terms of the area surface or circumference in those areas?
A That's -- that's part of it. It also has to do with

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what's the magnitude of the pressure that's acting normal to the hopper wall.
Q But just in lay terms, if I'm understanding it, the hoop stresses at the bottom where they have the discharge are going to be substantially less than the hoop pressures we're going to have at the top of the hopper?
A In general, that statement is true.
Q Okay.
A There are exceptions. But, in general, that's true.
Q Is there any exceptions in this case to that?
A I assume we're talking now just gravity-induced, material-induced loads, nothing to do with collapsing arches or ratholes; is that correct?
Q Well, I want to get to that a little bit later. But right now I'm just trying to understand, you know, that hoop stresses generally are lesser at the bottom and more at the top of the hopper. And I think we agreed generally that was. There might be some exception, correct?
A Yes, sir.
Q And my question is what exceptions might there be?
A The hoop stress calculation depends upon the amount of -- in the case of a hopper storing a bulk solid, the hoop stress depends on the pressure that's acting

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normal or perpendicular to that wall surface, the thickness of the metal, and the -- in the case of a conical hopper, the diameter of the hopper at that point in question.
The -- so let's take each of those in turn. As far as the normal pressure is concerned, pressure acting normal to the hopper surface, the change of normal pressure as one moves from the top of the hopper to the bottom depends on the hopper angle. It depends on the friction, the coefficient of sliding friction between the bulk solid and the wall material. It depends on a parameter. It usually is the initial K, the letter K is used. But it's the ratio of the pressure normal to the wall divided by the pressure that's acting vertically downward.
So in most instances, unless you have a very low coefficient of sliding friction between the bulk solid and the wall, the pressure that acts normal to the wall is going to decrease from the top to the bottom, both in terms of initial pressures and, if you had a mass flow bin, in terms of flow pressures.
The second factor, of course, is the thickness. Very often hoppers are the same thickness top to bottom. So if that is the case, then that doesn't come into account.



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And the third factor, then, would be the diameter, which is in the denominator. So as the -- I'm sorry. It's in the numerator. So as the diameter decreases, the pressure decreases. So in general, you have -- unless you have an extremely low coefficient of sliding friction or some reason why the K value is changing, you would get lower pressures acting in the lower portion of the hopper than in the upper portion.

Q Well, I noted I think in Exhibit 29, on 5, your first sentence there. "As I noted in my previous report, the hoop stresses generated by gravity-induced pressure acting on the hopper walls were considerably smaller in the lower portion of the hopper than higher up."

Did I read that correctly?

A Yes, sir.

Q And at that point, then, you're saying that with gravity-induced pressures is that there's going to be lower hoop stress at the bottom of the hopper than there is at the top?

A In this particular instance, yes.

Q Okay. Now, I want to talk to you about, when you talk about gravity-induced, what does that mean?

A It means the pressure that the material exerts against the walls of a storage vessel, the cylinder, and the hopper portion simply as the result of gravity acting

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on the material. It excludes any effects of air cannons, vibrators, collapsing arches, collapsing ratholes or whatever. Simply it's there because gravity acts on the material.

Q Now, would I be correct, though, that when a rathole or arch collapses is that that's still collapsing because of gravity?

A Well, it is, that's correct. Gravity is always present, but it's a different phenomena than what I'm talking about here.

Q And that's what I'm trying to --

A Right.

Q -- to put in context here, because I understand you're talking more about the, what I would term more static loading or consistent decreased pressures as you go through the process of discharging a full hopper?

A Yes, sir.

Q And so when we're talking about gravity-induced, that's kind of what you're referring to?

A Yes, sir.

Q And then you're not talking about the gravity force when there's a collapse on a rathole or a bridge?

A That's correct.

Q Okay. I want to talk to you a little more about the video, and that's going to be Exhibit 29.

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A Yes.

Q I think that's the -- Exhibit 29 is a supplement that you reported on after seeing the video, correct?

A Yes.

Q And am I correct that your interpretation of what happened is from your observations that you personally have made in viewing the sequencing scenes from the videotape?

A That's correct.

Q And we're not talking about an engineering opinion or any engineering part that went into that; that's purely an observation that you're making?

A Yes. I'm drawing engineering conclusions from those observations.

Q Right. And I understand your conclusion. I mean, I've gone through it and have taken a look at it.

Then in terms of where you're looking at on this video, you're looking at about 20 panels, correct?

A I don't know the number of panels that I'm looking at. The video is what it is. I don't recall the number.

Q Okay.

A But there's a number of panels, yes.

Q Correct. And the video's only going to show one side, correct?

A That's correct, yes.

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Q And we have no evidence of what occurred on the other side of the hopper, correct?

A I wouldn't say necessarily. Again, we're only looking at one side. But if something were happening on the opposite side, particularly the release of a puff of dust or particles, that would -- that would be visible as well -- or could be visible.

Q Okay. But let's break this down. From the videotape analysis we're only looking at one side, correct?

A Yes.

Q And from the videotape analysis we can't see or determine what was going on on the opposite side?

A We can't see directly, that's true. We can only see after the fact if something happened on the other side.

Q And is there anything after the fact that would -- that you're using, that you haven't expressed in 29, that would support the opinion that the failure occurred in the lower portion of the bin?

A Say that again, sir.

Q Okay. Is there any other data other than the videotape that you're using to form the opinion that the breach of the hopper occurred in the lower portion of the hopper?

A Yes.

Q What's that?



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A. Mr. Nohr's report.
Q. And what about Mr. Nohr's report are you referring to then?
A. Where he stated that the failure initiated at the bottom of the hopper.
Q. Okay. I understand that's his opinion, but have you used any documentation that he has as to that opinion --
A. No, I just have --
Q. -- as to how he got there?
A. No, I just have his report.
Q. So you're just taking his report, this is what he says?
A. That's in addition to my own viewing of the video, correct.
Q. Okay. So in forming your opinions that are expressed in Exhibit 29, you've looked at the video and you looked at Mr. Nohr's report?
A. That's correct.
Q. And that would be the sum total of what you reviewed then --
A. Yes.
Q. -- correct?
A. Yes.
Q. Have you made any determination as to the location or side -- size of a void created by a rathole or arching?

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A. No.
Q. Have you made any determination as to whether the material inside was a collapse of a rathole or a collapse of an arch?
A. No, I haven't differentiated between the two.
Q. Now, you're not critical of Sioux Steel in securing an outside firm to review the structural integrity of their hopper designs, are you?
A. No.
Q. That would be an appropriate thing to do?
A. Yes.
Q. You said earlier that you determined what did cause the failure, and I think we discussed that it probably was a rathole or an arch collapse, correct?
A. In that it's the most probable cause of the failure, in my opinion.
Q. Okay. And then I think you said you've also determined what did not cause?
A. Yes.
Q. Now, what did not cause this failure, in your opinion?
A. Can I refer to my report just to make sure --
Q. Certainly.
A. -- I don't miss something?
(Examines document.)
I think this is most directly stated by my opinion

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11 on page 11, which reads, quote, the silo did not fail because of material-induced loads resulting from gravity alone, closed quotes.
Q. Let me just catch up with you. All right. Okay. I'm there.
Okay. We're at 11. That's page 11?
A. Yes, sir.
Q. And their silo did not fail because of material-induced loads resulting from gravity alone?
A. Yes.
Q. Okay. And then point out the quote that you just read for me, if you would, please.
A. The quote that I just --
Q. Yeah, maybe I misunderstood. I thought you read --
A. I read the title of No. 11 which --
Q. Gotcha. Okay.
A. -- you just -- which you just read back to me.
Q. And so -- and we talked about this earlier, though. When you're talking about gravity-induced loads, is that you're not talking about the dynamic impact of a collapse of a rathole or an arch, correct?
A. That is correct.
Q. Okay. I want to just discuss a couple things in your opinion on Exhibit 28. And let's go to No. 6, if you would, on page 7.

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A. Okay.
Q. And the last sentence there, it says, By omitting such a statement, one could assume that this was an oversight of KC's part. However, as explained below in opinion 13, even if this joint had been strengthened to meet code requirements, it would still have failed.
Is that your opinion?
A. Yes, sir.
Q. Okay. Will you tell me how you arrived at the conclusion that if the seam had met code requirements it would still have failed?
A. As Mr. Godoy noted in his report, the seam -- the bolted seam at the top of the hopper was overstressed in relation to the design code, but it was not stressed to the point where failure would be predicted.
Second, the magnitude of loads and pressures that would result from the collapse of an arch or a rathole are so large compared to what I'm calling material-induced loads by gravity alone, that slightly increasing the strength of a connection perhaps by a factor of two or so to meet code requirement for allowable loads would not have been able to resist that.
And third, and perhaps most importantly, is the fact that, in my review of the video and in the view of

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Mr. Nohr, the failure occurred not at the region where the bolted joint was below code, namely at the top of the hopper, but instead the failure occurred near the bottom of the hopper where that bolted joint was far less loaded and certainly well designed to withstand gravity-induced loads. And, therefore, a collapse of a rathole was what caused the failure.

So it's a long about way of saying that if KC Engineering had looked at that radial joint at the top of the hopper and made a recommend -- or found that it was not up to code limit and it should have been made stronger, that would have -- that if that change had been made, that would not, in my opinion, have prevented this failure.

Q Okay. And I want to just kind of go through these. The ESI report, Mr. -- I never pronounce his name correctly -- that was his observation?

A I'm sorry. What was his observation?

Q The ESI, Mr. Godall or Godow?

A I don't know the gentleman, so I -- but it's G-o-d-o-y. I think it's Godoy, but I don't know.

Q Okay. I don't either, so -- and I don't know him. But, anyway, is that he's saying that the top was stressed. And that's where you then have incorporated, in your opinion, that the top of the seam was stressed

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at the hopper?

A What Mr. Godoy noted was that the radial seam, the bolted radial seam near the top of the hopper was stressed greater than the allowable, which includes a factor of safety.

But, again, allowable includes a factor of safety. He found that if you take that factor of safety away, that the amount of stress would not have predicted failure of the -- of that seam. And I agree with that analysis.

Q Is there any way for us to determine the observations that Mr. Godoy made, whether that stress occurred before or during the failure process?

A Again, I don't think Mr. Godoy made any observations. He did calculations. And those calculations were based on the assumption that the -- what I'm calling the material-induced loads by gravity alone, ignoring ratholing and ignoring collapse of a rathole or collapse of an arch, that those calculations resulted in what I just testified.

Q So the material-induced loads are the ones that caused stress to the top of the hopper seam?

A Absolutely. Sure. That always happens. There's nothing unique about that in this instance.

Q And we're talking about stress and we're talking about

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some deformation or deforming of the metal?

A Stress does not imply deformation, no.

Q Okay. Well, I'm struggling to understand the observation or what you're incorporating from this other report. And maybe it's just my lack of being able to grasp some of it.

Tell me again what you're adopting from Mr. Godoy. Are you adopting what he observed or his calculations?

A The latter.

Q Okay. And his calculations are relating to what?

A His calculations relate to what were the pressures that the material, the soybean meal, exerted on the walls of the hopper, both at the top and the bottom and throughout from top to bottom, and what that -- what those pressures then resulted in differing amounts of hoop stress, and then he looked at the ability of the bolted radial seams to resist that hoop stress. And what he found is that that amount of hoop stress at near the top of the hopper was greater than the allowable hoop stress for that particular bolted joint, but it was not great enough to predict or cause failure of that radial seam.

Q Did Mr. Godoy make an opinion as to where the breach occurred?

A As I recall -- and if you provide me his opinion, I --

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I could point it out directly. But my recollection is that he concluded that the failure started at the top of the hopper section, and the way he arrived at that conclusion was by improperly, in my opinion, mixing and matching different codes and different calculations to result in a condition that would predict failure.

But, again, that was not only an improper mixing and matching of different calculation methods but also is inconsistent with the video and Mr. Nohr's report.

Q Okay. And then the magnitude of the collapse of either the rathole or the arch is the second factor?

A Yes.

Q And the third factor is the video and Mr. Nohr's report?

A Yes.

Q Okay. Have I covered all those?

A I believe so, yes.

Q Okay.

A If I can just add to that, I think my opinion 13, beginning on page 12, goes into it in more detail. And I have several other reasons why it failed and why it didn't fail. And those are all listed bullet -- by bullet point on pages 12 and 13.

Q Okay. I want to try to see if I can just follow up here and get some of this so we can get to conclusion.



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By way of follow up, Exhibit 30 would have been the first contact that your company had with Sioux Steel; is that correct?
A Yes.
Q And looking at Exhibit 30, your engineer advised that the loading for your company was much higher compared to what Sioux Steel calculated; is that correct?
A That's what it states, yes.
Q And Sioux Steel was coming to you asking you to do a structural analysis on their hopper bins, correct?
A Yes.
Q Was there ever a letter sent by your company explaining why its calculations of loads were higher than what was calculated by Sioux Steel?
A Not that I'm aware of, and there's nothing that I'm aware of that's been produced by Sioux Steel to indicate that they -- the fact that they -- they don't even recognize or note the fact that they had the contact. Mr. Kramer's weekly notes doesn't even mention this contact.
Q Well, but we know that there was contact because of the fact that you found it in your files, correct?
A That's correct. I'm just saying, from their standpoint, there was -- there was no mention of it.
Q And I'm looking from your standpoint is that you're an

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engineering company, you have received plans, your engineer has taken a look at it, they've talked with Sioux Steel, correct?
A Yes.
Q Correct?
A They have taken --
Q That's correct?
A They've taken a cursory look. There was no job here. There was no payment for any services. It was simply a cursory look at -- apparently a cursory look at the drawings and then a phone conversation.
Q And --
A And that was the extent of it.
Q And you were reviewing it to obtain a client in order to perform services on structural engineering, correct?
A That's correct.
Q And your company came to the conclusion, through your engineer, that your loading would be much higher compared to what Sioux Steel calculated in the plans that they submitted; is that fair?
A That's correct.
Q And having received this, though, understanding then that, from your perspective of your company, the plans were deficient, did your company ever send a letter back to Sioux Steel saying, these are the issues you

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need to take a look at with EP 433?
A Not that I'm aware of.
Q Now, had you been there and had you addressed EP 433 with Mr. Kramer, you would have told him similar things that you have set out in Exhibits 28 and 29, correct?
A Very likely I would have.
Q And what we've discussed today?
A Very likely I would have. Again, you can only push things so far. If a client -- a potential client is set in their ways and doesn't want to talk about it, you can only go so far in trying to convince them that they're wrong.
Q Isn't there a duty on the part of an engineering firm that if the client's plans are not adequate, to advise them of that?
A And I believe that was done here.
Q It doesn't say anything here where Sioux Steel was advised that the loading is much higher compared to what G&J [sic] would have had; it simply is an internal memo, correct?
A It's a -- this is an internal note of a phone discussion between our Mr. Petro and Mr. Kramer of Sioux Steel.
Q And Mr. Petro is not with us anymore, so we can't talk to him about what was said, correct?

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A Unfortunately, that's the case, yes.
Q When you incorporated and referred to Exhibit 30 in your report, did you have consent from Sioux Steel?
A No.
Q Did you attempt to get consent from Sioux Steel?
A No.
Q Do you understand that your use of the information in Exhibit 30 and the contact that Sioux Steel had with you is now being used adversely by your firm and by you against Sioux Steel?
A I don't understand that at all.
Q Would you go to Exhibit No. 28 and look at page 12, item 12.
A Okay.
Q And item 12 says that Sioux Steel Corporation's Mr. Kramer was aware that higher material-induced loads should have been used to design the hopper section?
A Yes.
Q Is that correct?
A Yes.
Q And you are imputing that knowledge that Mr. Kramer had based on Exhibit 30, correct?
A That is correct.
Q And so you're using Exhibit 30 adversely against Sioux Steel, your potential client, and in favor of KC, your



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present client, to come to the conclusion of what Mr. Kramer was aware of, correct?
A I don't see it adverse at all, sir. It's --
Q Pardon?
A -- simply a fact.
I don't see it adverse at all, sir. I see it simply as a factual statement.
Q So you're a fact witness in this case as well as an expert?
A As relates to opinion 12, I'm essentially a fact witness, that's correct.
Q And we have no basis to conclude on Exhibit 30 that Mr. Petro, the author of that exhibit, ever told Mr. Kramer that there needed to be higher material-induced loads used?
A All we have is what's here. So it states -- the words are the words that are there. I can't go beyond what's there to --
Q Well, you have gone beyond that because you've imputed that Mr. Kramer knew that. In order for Mr. Kramer to know that, Mr. Petro would have had to explain to him that the loads of J.C. [sic] are much higher compared to Sioux Steel, correct?
A The loads that J.C.? Who is J.C.?
Q That our loading is much higher compared to that that

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Sioux Steel calculated.
A Yes, I -- knowing Mr. Petro as long as I did, he wouldn't write something like this unless he had told this to a potential client.
Q So now you're projecting what he did or didn't do on his behavior?
A I am, based on my working with him for some 20 years. He wouldn't write something like this unless he told the client. If there's a potential job here, he would have --
Q Okay. And now --
A -- he would have written a proposal, and he didn't do so. In fact, he wrote here that there's no job here, so therefore there was no need to write a proposal.
Q So the information that you're now using, then, is that Sioux Steel knew there should have been higher material-induced loads --
A That's correct.
Q -- comes from the contact that Sioux Steel had with your company, correct?
A Yes.
Q And you're now using that conduct and what you think that Mr. Petro may have done adversely to Sioux Steel?
A I wouldn't say might have done. I think most probably did do, yes.

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Q Okay. So what he most probably did do is adversely to Sioux Steel?
A Again, sir, this -- I don't see it's adverse or not adverse. This is a factual statement.
Q Well, there's no factual statement that we have that's in writing that shows that Sioux Steel was aware that higher load -- higher material-load induced calculations were necessary.
A All we have is Exhibit 30. As I --
Q And that doesn't say that, does it?
A It doesn't say those specific words, that is correct.
Q Thank you.
MR. GOODSELL: I think I'm about done, Counsel. Can I take a break for about five minutes, and we'll finish up and get everybody out of here, okay?
THE VIDEOGRAPHER: The time is 10:49. We are off the record.
(Recess taken from 10:49 a.m. to 11:06 a.m.)
THE VIDEOGRAPHER: We are back on the record. The time is 11:06.
MR. GOODSELL: Mr. Carson, I want to thank you for coming here and chatting with me today, helping me understand a little bit better about some of the processes and how you got to some of your conclusions. I don't have any more questions.

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THE WITNESS: Thank you, sir.
MR. TOBIN: Thank you. And we will read and sign.
THE VIDEOGRAPHER: Ready to go off the record? The time is 11:06. This concludes the video deposition of John Carson. We are off the record.



EXHIBIT E